

**REMARKS**

Claims 2, 3 and 5-13 are all the pending claims. Claims 1 and 4 are deleted. Claims 2, 3, 4, 5 and 7-10 are currently amended. Claims 11-13 are newly added.

**I. The Rejections Under 35 U.S.C. §103(a)**

Claims 2, 3 and 7 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP '611 in view of Takahashi, Sunagawa and either JP '909 or JP' 229.

Claims 2, 3, 7 and 9 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP '611 in view of Takahashi, Sunagawa and/or JP '398.

Claims 5, 6, 8 and 10 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP '611 in view of Takahashi, Sunagawa, JP '398 and either JP '909 or JP '229.

Applicants respectfully submit that the present invention is not rendered obvious over the disclosures of the cited art and request that the Examiner reconsider and withdraw these rejections in view of the following remarks.

The following elements are contained in Applicants' claims:

- a-** The positive electrode active material consists of a lithium cobalt oxide, and the positive electrode active material has a bulk density in the positive electrode of  $3.3 \text{ g/cm}^3$  or more;
- b1-** A vinylene carbonate compound represented by Chemical Formula 1;
- b2-** A cyclic sulfite compound represented by Chemical Formula 2 or 3;
- b3-** A phenylcycloalkane compound having a cycloalkyl group bonded to a benzene

ring; and/or

**b4-** An alkylbenzene compound having a quaternary carbon directly bonded to a benzene ring.

Applicants' claimed invention includes the following elements **a** and **b1** to **b3**, or **a**, **b1**, **b2**, and **b4**, or **a** and **b1** to **b4**. See claims 2, 11 and 5, respectively.

In the "Response to Arguments" section (page 13 of the Office Action), the Examiner stated that Applicants' claims do not preclude the combination of positive active material as recited in Sunagawa and thus can include a mixture of lithium cobalt compound oxide as well as lithium manganese oxide.

Independent claims 1 and 5 have been amended to recite "the positive electrode active material consists of a lithium cobalt oxide." Likewise, new claim 11 uses the same closed claim language.

Applicants' respectfully submit that the cited art does not teach or disclose Applicants' claimed invention and that Applicants' claimed invention provides unexpectedly superior properties over the cells of the cite art.

The cells recited in Table 1 below are comparisons of cells of the claimed invention with cells representative of the cited art. The cells X3, X4, and X5 have been added, and the data regarding them were measured under the same conditions as in the present invention.

(1) JP '611

JP '611 lacks the claim element **a**, "the positive electrode active material has a bulk density in the positive electrode of 3.3 g/cm<sup>3</sup> or more."

JP '611 discloses a non-aqueous electrolytic solution using a mixture solvent comprising ethylene sulfite (ES), vinylene carbonate (VC), and at least one selected from the group consisting of ethylene carbonate (EC), dimethyl carbonate (DMC), ethyl methyl carbonate (EMC), and diethyl carbonate (DEC) (paragraph 0013). This non-aqueous electrolytic solution corresponds to X1 in Table 1.

JP '611 also lacks the claim elements **b3** and **b4**.

(2) JP '909

JP '909 lacks the claim element **a**, "the positive electrode active material has a bulk density in the positive electrode of 3.3 g/cm<sup>3</sup> or more."

Table 1 of JP '909 and Table 1 of JP '229 each show a non-aqueous electrolytic solution containing TAB (alkylbenzene compound)/EC/PC/DEC, TAB/EC/PC/DEC/DMC, or TAB/EC/PC/MEC/OWC. The non-aqueous electrolytic solutions correspond to X4 in Table 1.

JP '909 also lacks the claim element **b3**.

(3) JP '398

JP '398 lacks the claim element **a**, "the positive electrode active material has a bulk density in the positive electrode of 3.3 g/cm<sup>3</sup> or more."

JP '398 discloses a non-aqueous electrolytic solution containing PCH (phenylcycloalkane compound)/EC/DEC/MB (paragraph 0081 and example 1 in Table 1). The non-aqueous electrolytic solution corresponds to X3 in Table 1.

JP '398 also lacks the claim element b4.

(4) Sunagawa (US6,818,351)

Sunagawa lacks the claim element **a** because the cited reference uses a mixture positive electrode active material of lithium containing manganese oxide and lithium containing cobalt oxide.

Sunagawa also lacks the claim elements **b2** to **b4**.

(5) Takahashi (US6,632,572)

Takahashi lacks the claim element **a**, "the positive electrode active material has a bulk density in the positive electrode of 3.3 g/cm<sup>3</sup> or more."

Takahashi discloses in example 6 (paragraph 0024) and example 8 (paragraph 0025) a non-aqueous electrolytic solution containing PCH (phenylcycloalkane compound)/EC/DEC. The non-aqueous electrolytic solution corresponds to X3 in Table 1.

Takahashi also lacks the claim element **b4**.

(6) The Present Invention

Cell A1 in Table 1 corresponds to the cell according to claim 2 of the present invention. Cell A2 corresponds to the cell according to claim 11 of the present invention. Cell A3 corresponds to the cell according to claim 5 of the present invention.

Unexpected Advantageous Effects of Applicants' Claimed Invention

Applicants have prepared data to prove that a secondary cell of the present invention comprising all the claim limitations is unexpectedly superior over a secondary cell as in the cited art, which lacks at least one of the claim limitations. The data is attached herein as Table 1.

Table 1 shows that the capacity maintenance rate of cell X1 (JP '611) is 61%, that of cell X3 (JP '398 and Takahashi) is 32%, and that of cell X4 (JP '909) is 39%.

Table 1 also shows that the capacity maintenance rate of cell X2, which uses phenylcycloalkane compound and VC, is 55%, and that of cell XS, which uses alkylbenzene compound and VC, is 58%.

To the contrary, the capacity maintenance rates of inventive cells A1 to A3 are unexpectedly superior, as high as 81 to 85%.

Table 1 also shows that cells X1 to X5 showed solution leakage, while inventive cells A1 to A3 showed no solution leakage.

Table 1

| cell | additive composition (wt.%) |        |         |         | cycle characteristics<br>capacity<br>maintenance<br>rate (%) | high temperature standing tests results |                     |            |
|------|-----------------------------|--------|---------|---------|--|---|---------------------|------------|
|      | VC(e2)                      | ES(e3) | PCH(e4) | TAB(e5) |  | solution leakage                        | current cutting-off | evaluation |
| X1   | 2.0                         | 0.5    | 0.0     | 0.0     | 61   | found                                   | found               | bad        |
| X2   | 2.0                         | 0.0    | 2.0     | 0.0     | 55   | found                                   | found               | bad        |
| A1   | 2.0                         | 0.5    | 2.0     | 0.0     | 85   | not found                               | found               | good       |
| A2   | 2.0                         | 0.5    | 0.0     | 3.0     | 81   | not found                               | not found           | excellent  |
| A3   | 2.0                         | 0.5    | 1.0     | 1.0     | 83   | not found                               | not found           | excellent  |
| X3   | 0                           | 0      | 2       | 0       | 32   | found                                   | found               | bad        |
| X4   | 0                           | 0      | 0       | 2       | 39   | found                                   | found               | bad        |
| X5   | 2                           | 0      | 0       | 3       | 58   | found                                   | found               | bad        |

Thus, the inventive cells provide unexpected advantageous effects compared with the cells of the cited references, which lack at least one of the claim elements. Further, the effects are unexpected in the art for at least the following reasons.

Generally, although an increase in the bulk density of lithium cobalt oxide as the positive electrode active material increases the positive capacity, the cycle characteristic reduces. The present invention (e.g., claims 2, 5, and 11) uses lithium cobalt oxide as the positive electrode active material wherein the positive electrode active material has a bulk density in the positive electrode of 3.3 g/cm<sup>3</sup> or more, and the non-aqueous electrolyte contains a vinylene carbonate compound represented by Chemical Formula 1, a cyclic sulfite compound represented by Chemical Formula 2 or 3, a phenylcycloalkane compound having a cycloalkyl group bonded to a benzene ring; and/or an alkylbenzene compound having a quaternary carbon directly bonded to a benzene ring.

This configuration provides the effects of inhibiting a decrease in the cycle characteristic in high temperature even when the bulk density of the lithium cobalt oxide is increased and increasing the capacity. These effects are significantly advantageous effects not expected from the cited references. The advantageous effects are provided in the present invention because the positive electrode active material has a bulk density in the positive electrode of  $3.3 \text{ g/cm}^3$  or more.

Sunagawa et al. does disclose a positive electrode having a positive electrode material at a bulk density of more than  $3.3 \text{ g/cm}^3$ . However, the object of the invention of Sunagawa et al. is to improve the load characteristic when a positive electrode material mixture of lithium cobalt oxide and lithium manganese oxide is used. Sunagawa et al. realizes this object by adjusting the ratio of lithium cobalt oxide and lithium manganese oxide, and making the average particle diameter of lithium manganese oxide larger than that of lithium cobalt oxide (see Abstract, Summary of Invention of Sunagawa et al.).

Contrarily, the object of the present invention is to improve the cycle characteristic when lithium cobalt oxide is used as the positive electrode active material and the positive electrode active material has a bulk density in the positive electrode of  $3.3 \text{ g/cm}^3$  or more. The present invention realizes this object by adding a specific component in the non-aqueous electrolyte.

Again, Applicants have amended the claims to clearly recite that the positive electrode active material consists of lithium cobalt oxide, in order to distinguish the claims over Sunagawa et al. The present amendment also clarifies that however the cited references are combined, claimed elements are missing.

There is no motivation or reason to combine Sunagawa et al. with Takahashi, JE'611, JP'229, and JP'398 to achieve Applicants' claimed invention. The prior art references tribunal must be read as a whole and consideration must be given where references diverge and teach away from the claimed invention. Moreover, one cannot pick and choose among individual parts of assorted prior art references "as a mosaic to recreate a facsimile of the claimed invention." Akzo N.V. v. U.S. International Trade Commission, 1 USPQ 2d 1241, 1246 (Fed. Cir. 1986, citations omitted).

For the above reasons, it is respectfully submitted that the subject matter of claims 2, 3 and 5-10 is neither taught by nor made obvious from the disclosures of the cited art, either alone or in combination and it is requested that the rejections under 35 U.S.C. §103(a) be reconsidered and withdrawn.

## **II. Conclusion**

In view of the above, Applicants respectfully submit that their claimed invention is allowable and ask that the rejections under 35 U.S.C. §103 be reconsidered and withdrawn. Applicants respectfully submit that this case is in condition for allowance and allowance is respectfully solicited.

If any points remain at issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the local exchange number listed below.

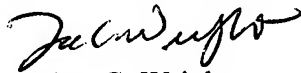


Amendment Under 37 C.F.R. §1.111  
Application No. 10/670,384  
Attorney Docket No. 031201

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

**WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP**

A handwritten signature in black ink, appearing to read "Lee C. Wright", written in a cursive style.

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